



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

*Handwritten signature/initials*

Art Unit : 1742  
Examiner : Sikyin Ip  
Serial No. : 09/937,889  
Filed : October 2, 2001  
Inventors : Akio Tosaka  
: Sinjiro Kaneko  
: Yoichi Tominaga  
: Noriyuki Katayama  
: Nobutaka Kurosawa  
: Kei Sakata  
: Osamu Furukimi  
Title : HIGH TENSILE HOT-ROLLED STEEL SHEET  
: HAVING EXCELLENT STRAIN AGING  
: HARDENING PROPERTIES AND METHOD  
: FOR PRODUCING THE SAME

Customer No.: 035811

Docket No.: 1307-01

Confirmation No.: 8803

Dated: November 17, 2006

**Mail Stop Appeal Brief - Patents**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

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Appendix of Currently Pending Claims

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Name of Appellant, Assignee, Appellant's Attorney  
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Customer No. 035811

By: *Christina A. Silghman*

Date: 11/17/06



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**APPEAL BRIEF**

**Mail Stop Appeal Brief - Patents**

Commissioner for Patents

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Sir:

The Appellants have appealed from the rejection of Claims 1-5, 10, 12 and 14-19. The Appellants submit this Appeal Brief and a check in the amount of \$500.00 under 41 CFR §41.20(b)(2).

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**REAL PARTY IN INTEREST**

The real party in interest, by Assignment recorded in the USPTO records at Reel 012630 and Frame 0162, is JFE Steel, a corporation of Japan located at 1-10, Nihonbashi 2-chome, Chuo-ku, Tokyo 103-0027, Japan.

## **RELATED APPEALS AND INTERFERENCES**

None

## **STATUS OF THE CLAIMS**

The Appellants' Claims 6-9, 11 and 13 were canceled without prejudice and without disclaimer of the subject matter thereof. Claims 1-5, 10, 12 and 14-19 are rejected and on appeal. Claims 1, 2, 10 and 12 are independent claims.

## **STATUS OF THE AMENDMENTS**

The following Amendments are of record: an Amendment filed January 6, 2004 in response to a Non-final Official Action dated November 5, 2003; an Amendment filed July 7, 2004 in response to a Final Official Action dated April 13, 2004; a Supplemental Response and a Request for Continued Examination filed September 10, 2004 in response to the April 13, 2004 Official Action and an Advisory Action of July 27, 2004; a Response filed April 4, 2005 in response to a Final Official Action dated December 17, 2004; a Request for Continued Examination filed May 6, 2005 in response to an Advisory Action dated April 15, 2005; an Amendment filed September 26, 2005 in response to a Non-final Official Action dated July 27, 2005; a Response filed March 6, 2006 in response to a Final Official Action dated January 3, 2006; an Amendment and a Request for Continued Examination filed May 22, 2006 in response to a Final Official Action dated January 3, 2006, and an Advisory Action dated April 4, 2006; a Notice of Appeal filed July 12, 2005 in response to the Non-final Official Action dated June 26, 2006.

## **SUMMARY OF CLAIMED SUBJECT MATTER**

### **Claim 1**

The claimed subject matter relates to a high tensile strength hot-rolled steel sheet having superior strain aging hardenability comprising in percent by mass 0.15% or less of C; 0.45% or less of Si; 3.0% or less of Mn; 0.08% or less of P; 0.02% or less of S; less than 0.02% of Al; 0.0050% to 0.0250% of N; and the balance being Fe and incidental impurities, the ratio N (mass%)/Al (mass%) being 0.3 or more, N in the dissolved state being 0.0030% or more, wherein the hot rolled steel sheet has a ferrite phase with an average grain size of 10  $\mu\text{m}$  or less. (See the Specification Page 8, Lines 14-23; Page 19, Lines 20-25; Page 20, Line 1; Page 22, Lines 17-18; and Page 52, Table 1.)

### **Claim 2**

The claimed subject matter also relates to a high tensile strength hot-rolled steel sheet having superior strain aging hardenability with a tensile strength of 440 MPa or more comprising in percent by mass 0.15% or less of C; 0.45% or less of Si; 3.0% or less of Mn; 0.08% or less of P; 0.02% or less of S; less than 0.02% of Al; 0.0050% to 0.0250% of N; and the balance being Fe and incidental impurities, the ratio N (mass%)/Al (mass%) being 0.3 or more, N in the dissolved state being 0.0030% or more, wherein the hot-rolled steel sheet has a structure in which the areal rate of the ferrite phase having an average grain size of 10  $\mu\text{m}$  or less is 50% or more. (See the Specification Page 8, Lines 24-25; Page 9, Lines 1-9; Page 19, Lines 20-25; Page 20, Line 1; Page 22, Lines 17-18; and Page 52, Table 1.)

### **Claims 3-5**

Claims 3-5 are dependent claims. Claim 3 contains subject matter which includes additional elements and may be at least one selected from the group consisting of the following Group A to Group D: Group A 1.0 or less and total of at least one of Cu, Ni, Cr, and Mo; Group B 0.1% or less

in total of at least one of Nb, Ti, and V; Group C 0.0030% or less of B; and Group D 0.0010% to 0.010% in total of at least one of Ca and REM. (See the Specification, Page 23, Line 9 through Page 24, Line 25.)

Claim 4 includes subject matter reciting that the high tensile strength hot-rolled sheet has a thickness of 0.4 mm or less.

Claim 5 recites that the steel sheet may be a plated steel sheet produced by electroplating or hot-dipped plating. (See the Specification, Page 35, Lines 4-18.)

#### **Claim 10**

The claimed subject matter further relates to a high tensile strength hot-rolled steel sheet having superior strain aging hardenability with a BH of 80 MPa or more, a  $\Delta TS$  of 40 MPa or more, and a tensile strength of 440 MPa or more comprising in percent by mass 0.15% or less of C; 0.45% or less of Si; 3.0% or less of Mn; 0.08% or less of P; 0.02% or less of S; less than 0.02% of Al; 0.0050% to 0.0250% of N; and the balance being Fe and incidental impurities, the ratio N (mass%)/Al (mass%) being 0.3 or more, N in the dissolved state being 0.0030% or more, wherein the hot rolled steel sheet has a structure in which the areal rate of the ferrite phase having an average grain size of 10  $\mu\text{m}$  or less is 70% or more and the areal rate of the martensite phase is 5% or more. (See the Specification Page 11, Lines 10-21; Page 19, Lines 20-25; Page 20, Line 1; Page 22, Lines 17-18; and Page 52, Table 1.)

#### **Claim 12**

The claimed subject matter relates to a high tensile strength hot rolled steel sheet having superior strain aging hardenability comprising in percent by mass 0.15% or less of C; 0.45% or less of Si; 3.0% or less of Mn; 0.08% or less of P; 0.02% or less of S; less than 0.02% of Al; 0.0050% to 0.0250% of N; and the balance being Fe and incidental impurities, the ratio N (mass%)/Al (mass%)

being 0.3 or more, N in the dissolved state being 0.0030% or more, the total of precipitated Nb to precipitated V being 0.015% or more, wherein the hot rolled steel sheet has a structure in which the areal rate of the ferrite phase having an average grain size of 10  $\mu\text{m}$  or less is 80% or more and the average grain size of a precipitate comprising Nb carbonitride or a V carbonitride is 0.05  $\mu\text{m}$  or less. (See the Specification Page 12, Lines 20-25; Page 13, Lines 1-9; Page 19, Lines 20-25; Page 20, Lines 1; Page 22, Lines 17-18; and Page 52, Table 1.)

#### **Claims 14-15**

Claims 14 and 15 are dependent claims and contain the subject matter that the steel sheet may be a plated steel sheet produced by electroplating or hot-dipped plating. (See the Specification at Page 35, Lines 12-18.

#### **Claims 16-19**

The claimed subject matter still further relates to a high tensile strength hot rolled steel sheet having superior strain aging hardenability wherein the ratio N/Al is 0.6 or more. (See the Specification Page 22, Lines 19-25; Page 23; Lines 1-8; and Page 52, Table 1.)

### **GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

Claims 1-5, 10, 12 and 14-19 are rejected under 35 U.S.C. §112, first paragraph.

Claims 1-5, 10, 12 and 14-19 are rejected under 35 U.S.C. §103(a) over Maid (U.S. Patent No. 4,790,889) in view of Tosaka (U.S. Patent No. 5,074,929).

## ARGUMENT

### *Rejection of Claims 1-5, 10, 12 and 14-19 under 35 U.S.C. §112, first paragraph*

The rejection states that all of Claims 1-5, 10, 12, and 14-19 fail to comply with the written description requirement because they contain subject matter that was not described in the Specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors had possession of the claimed invention. This is based on two points that are set forth in all of independent Claims 1, 2, 10, and 12.

The rejection first specifically states:

The instant claimed limitation “0.45 or less of Si” in Claims 1, 2, 10, and 12 have no literal support in the Specification originally filed.

Applicants argue that Page 52, Table 1, Steel No. 5 supports 0.45 wt%. But a point in the Specification cannot support a range. Case laws cited by Applicants are misplaced. For example, the difference between 2 wt% and 0.45 wt% Si is 1.55 wt% or 77.5%.

Claims 1, 2, 10 and 12 originally recited a range of 2.00% or less of Si. They now recite that there is 0.45% or less of Si. This range is inherently supported in the Appellants’ disclosure by virtue of the fact that the originally filed range was 2.0% or less of Si. All of the entire new range of 0.45 or less of Si is encompassed in the original 2.0% or less of Si range. Thus, the Appellants respectfully submit that support is inherent. Also, the Appellants invite the Board’s attention to Table 1 of their Specification on page 52, wherein 0.45 is directly supported by Steel No. 5. The Table also includes additional lower quantities of Si such as 0.35, 0.25 and 0.15, for example. This range is thus further supported by actual Examples in the Appellants’ Specification.

The Appellants also commend MPEP 2163.05, part III to the Board’s attention. That portion of the MPEP leaves no doubt that inherent support is completely sufficient to meet the requirements of 35 U.S.C. §112.

MPEP 2163.05 also discusses the *Wertheim* case, which is discussed below. The Appellants also note the later and similar *Ralston Purina* case. The citations for those cases are as follows: *In re Wertheim*, 191 U.S.P.Q. 90 (CCPA 1976) and *Ralston Purina Co. v. Far-Mar-Co., Inc.*, 227 U.S.P.Q. 177 (Fed. Cir. 1985). In the *Wertheim* case, the Appellants sought the advantage of the filing date of a Swiss application describing a step of a process achieving a solid concentration of “25 to 60%” and gave specific examples of 36% and 50%. The U.S. claims, which had been rejected, called for a smaller range of concentration “between 35% and 60%.”

In construing the question whether the U.S. claim was entitled to the right of priority, the Court applied §112. The Court also considered whether persons skilled in the art would consider processes within the smaller range to be part of the Appellant’s invention and would be led by the disclosure to so conclude. Accordingly, notwithstanding the lack of literal support, the Court held that there was actual support, even though the corresponding disclosure did not disclose a 35% lower limit of the U.S. claims.

In *Ralston Purina*, a grandparent disclosure set forth a temperature range of 212° to 380°F. The later application claimed a range of 212° to 310°F. The Court of Appeals for the Federal Circuit applied the test as to whether the narrow range was sufficiently described in the later application to comprise a suggestion to those skilled in the art that such a range was embraced by the original invention. The Court applied the description requirement of 35 U.S.C. §112 in stating that the Appellant’s claimed range “involves [nothing] more than claiming a portion of that which has already been described. The Court proceeded to allow the narrower range despite the lack of literal support in the later specification.

The Appellants respectfully submit that both *Wertheim* and *Ralston Purina* are controlling in this case. Their clear stand on this issue supports the Appellants’ claimed range of 0.45% or less of

Si. The Appellants therefore respectfully submit that the amendment to Claims 1, 2, 10, and 12 with respect to the 0.45% or less of Si is in complete compliance with 35 U.S.C. §112.

The Appellants also respectfully submit that the above-mentioned disclosure in the original Claims 1, 2, 10, and 12, together with the general discussion of the quantity of Si in the Appellants' Specification such as that set forth on Pages 15 and 16 of the Appellants' Specification, Page 52, Table 1 of the Appellants' Specification, the MPEP and the relevant case law fully and completely supports the claimed range of 0.45% or less of Si such that it is clear to one skilled in the art that the Appellants were clearly in possession of the claimed subject matter at the time the application was filed.

In that regard, it is a simple matter to see that an originally disclosed range of 2.00% or less of Si inherently contains an infinite number of percentage points from 2.00% down to 0%. That infinite continuum of percentage points includes, among others, 0.45%. The Examiner's comments that a single point concerning Steel No. 5 in Table 1 "cannot support a range" demonstrates the Examiner's fundamental misunderstanding of the Appellants' position on this rejection. The Appellants cited Steel No. 5 as one of many examples that are explicitly set forth in the Appellants' Specification that run through the continuum of inherently supported points within the originally disclosed 2.00% or less range. The 0.45% point is further supported because there is an actual explicitly disclosed end point for the claim, namely 0.45% as supported by Steel No. 5. Of course, this squarely falls within the case law cited by the Appellants. That case law is exactly on point.

The Appellants respectfully submit that the fact that there is a 77.5% difference between the original 2.0 wt% upper limit and the 0.45 wt% upper limit is utterly irrelevant to the fact that the range of 0.45 wt% of Si is fully supported by the Appellants' original disclosure. The calculation of the difference between the two end points in the rejection is essentially a red herring that has no

bearing on the support issue at all. Reversal of the rejection as it applies to the “0.45% or less of Si” limitation is respectfully requested.

The second portion of the rejection is directed to the N/AI ratio of 0.3 or more. The rejection specifically states the following:

The instant claimed limitations N/AI ratio and N dissolved content in Claims 16-19 have no literal support in the Specification originally filed. In instant remarks, Applicants argue that “These ranges are inherently supported by virtue of the ‘or more’ language in each case.” But, N/AI being “0.3 or more” as originally claimed could merely mean 0.31 not 0.6 as instantly claimed. Same rationale holds true for N in the dissolved state.

The Appellants first note that the N/AI ratio is only contained within Claims 16-19. Therefore, Claims 1-5, 10, 12, and 14-15 are not included in this portion of the rejection. The Appellants also note that this rejection first arose in the context of amendments to Claims 1, 2, 10 and 12 which changed the original ratio from 0.3 or more to 0.6 or more. Those claims have been amended to restore the original ratio. However, the Appellants added Claims 16-19 to continue to claim that 0.6 or more ratio.

The originally claimed ratio was 0.3 or more. That range literally supports any range of 0.3. up to infinity. That means that any ratio greater than 0.3 is inherently supported by definition. In other words, the ratio of 0.3 or more represents a continuum of ratios beginning at 0.3 and extending upwardly to infinity. The Appellants have selected one of those points from the continuum of points and have narrowed the range from 0.3 or more to 0.6 or more. Of course, any range that is narrower than an originally disclosed range is inherently supported.

Nonetheless, the Appellants have invited the Examiner’s attention to various locations in the Specification to provide additional more explicit support for the claimed range. The Appellants therefore similarly invite the Board’s attention to Table 1 on Page 52 of the Appellants’

Specification, for example, wherein various N/AI ratios are set forth. Steel 23 has a low ratio of 0.31, which is within, but very close to the originally claimed range of 0.3 or more. There are a variety of additional ratios including, but not limited to, 0.86, 1.09, 1.27, 1.76, 2.36, 3.48, and so on. Those Examples provide additional support for the N/AI ratio of 0.6 or more. In fact, the Appellants respectfully submit that the Examples pointed out or include steels that have N/AI ratios below 0.6 in support of the original range of 0.3 in ranges close to and far above 0.6. For example, the 0.88 N/AI ratio is relatively close to 0.6. However, further ratios are provided that are actually multiples of the 0.6 ratios including 1.88, which is more than three times the 0.6 ratio and up to 3.63, which is more than six times the ratio.

The Appellants therefore respectfully submit that, when taken as a whole, the original disclosure both literally and inherently supports the Appellants' claimed ranges of N/AI ratios of 0.6 or more as set forth in Claims 16-19. The comments in the rejection that the N/AI range of 0.3 or more as originally claimed could merely mean 0.31 not 0.6 is contrary to the fact on the record. Although the Appellants fully agree that the original 0.3 or more language includes 0.31, the Appellants in no way agree that "or more" could have in any way be interpreted to be limited to 0.31. The Appellants have already discussed the fact that there is an example in the Specification, namely Steel 23, that has the ratio of 0.31. However, the Appellants provided multiple additional N/AI ratios far, far in excess of 0.3 and far, far in excess of 0.6 as set forth in Claim 16-19. The Appellants have already pointed out an example in the Appellants' Specification that was more than six times the currently claimed 0.6 ratio.

The Appellants' disclosure clearly conveys to one skilled in the art that the original 0.3 or more disclosure was in no way intended to "merely mean 0.31" as set forth in the rejection. The facts of record as set forth in the Appellants' Specification make it utterly clear to one skilled in the art that

the N/AI ratio was intended to range upwardly far beyond 0.31 and any position to the contrary is taken completely against the spirit and overtly disclosed facts in the Appellants' Specification. Reversal of that portion of the rejection as it applies to Claims 16-19 is also respectfully requested.

There is another portion of the rejection that is somewhat confusing in that it states "same rationale holds true for N in the dissolved state." This is apparently directed to a different portion of Claims 1, 2, 10, and 12. That limitation is not explicitly set forth in Claims 16-19. In any event, Claims 1, 2, 10, and 12 specifically recite that there is 0.0030% N in the dissolved state. This is different from the original language in Claims 1, 2, 10, and 12 that recited 0.0010% or more. Although the rejection does not overtly state this in exactly those words, the Examiner's brief comments in the rejection seem to indicate that there is a third rejection under §112 with respect to the N in the dissolved state limitation. To the extent that the rejection does not intend to reject that portion of Claims 1, 2, 10, and 12 over that limitation, the following discussion may be disregarded. However, in the interest of fully addressing what is believed to be the rejection, the Appellants will expressly address this point.

As noted above, Claims 1, 2, 10, and 12 originally recited that the amount of dissolved N was 0.0010% or more. The Appellants subsequently changed that lower limit from 0.0010% to 0.0030%. Apparently, the rejection takes the position that such a change is not supported. The Appellants disagree. In that regard, the Appellants invite the Board's attention to Page 22 of the Appellants' Specification. Among other things, Lines 17-18 specifically state:

The amount of dissolved N is preferably set at 0.0030% or more.

The Appellants respectfully submit that nothing could be clearer. The Appellants explicitly, overtly and directly state that the amount of dissolved N may be 0.0030% or more. On this basis alone, the

Appellants respectfully submit that the claimed amount of dissolved N being 0.0030% or more as set forth in Claims 1, 2, 10, and 12 is fully supported.

However, the rejection appears to take the position that the “or more” language should essentially be disregarded and that there is apparently some limitation on what the “or more” language means. The Appellants invite the Board’s attention to Table 3 on Page 54 of the Appellants’ Specification wherein dissolved N percentages are set forth for a variety of steel sheet numbers. It can be seen that Sheet K is indicated as being outside of the range since it is slightly less than the original range of 0.0010. Instead, Steel K is 0.0008. On the other hand, Sheet AB recites a dissolved N content of 0.0011%. This is just above the originally claimed 0.00010 percentage. In that regard, this appears to be analogous to the Examiner’s earlier statement that the N/Al ratio of 0.3 or more “could merely mean 0.31.” In that context, the rejection appears to take the position that “0.0010 or more” as originally claimed could merely mean 0.0010. The only thing that the Appellants agree to in that context is that 0.0011 is clearly within the original range of 0.0010 or more.

In any event, the Appellants provide a multiplicity of additional dissolved N percentages that far exceed not only the originally claimed 0.0010 or more range, but the 0.0030 or more range. For example, Steel W has a dissolved N amount of 0.101%. This far exceeds the currently claimed 0.0030 range. Steel B is even higher. It is 0.0121%. This is more than four times the currently claimed amount. The Appellants therefore respectfully submit that if one skilled in the art looks to the Appellants’ Specification in its entirety, it can readily be seen that not only is the original 0.0010 or more range fully supported, but so is the currently claimed 0.0030 or more range. Reversal of that portion of the rejection is also respectfully requested.

*Rejection of Claims 1-5, 10, 12 and 14-19 under 35 U.S.C. §103(a)*

Claims 1-5, 10, 12 and 14-19 are rejected under 35 U.S.C. §103(a) over Maid in view of Tosaka. The rejection first begins by stating that Maid discloses certain features of the claims and then acknowledges differences between Maid and the solicited claims.

The rejection takes the position that Maid discloses the “claimed steel alloy composition”, among other things. The Appellants disagree that Maid discloses the claimed steel alloy composition. This is easily verified by reference to the Appellants’ Claims 1, 2, 10, and 12 on the one hand and the Maid disclosure on the other hand. The Appellants’ broadest composition includes 0.15% or less of C; 0.45% or less of Si; 3.0% or less of Mn; 0.08% or less of P; 0.02% or less of S; less than 0.02% of Al; 0.0050% to 0.0250% of N with the balance being Fe and incidental impurities.

On the other hand, Maid discloses 0.05 to 0.16% of C; 0.5 to 1.0% of Si; 0.3 to 1.5% of Cr;  $\leq$  0.025% of P;  $\leq$ 0.015% of S; 0.02 to 0.10% of Al;  $\leq$ 0.011% of N; 0.2 to 0.4% of Mn and the remainder being Fe and incidental impurities.

There is at least one significant difference that appears immediately. In particular, Maid discloses 0.02 to 0.1% of Al. In sharp contrast, the Appellants’ Claims 1, 2, 10, and 12 recite less than 0.002% of Al. This means that at least with respect to Al, there is no overlap between what the Appellants claim and what Maid discloses. The result of this is that the Appellants’ “claimed steel alloy composition” is not the same as the steel alloy composition of Maid. Therefore, the Appellants respectfully submit that the rejection begins with a fundamental error. However, there are a variety of additional errors with respect to both Maid and the hypothetical combination of Tosaka with Maid.

Before proceeding to those errors, however, the Appellants do agree with the Examiner’s frank acknowledgement that Maid does not disclose the claimed N-Al ratio, the amount of dissolved N in the steel and the ferrite grain size. The Appellants also further agree that Maid does not disclose

Nb with respect to Claim 12 and Maid does not disclose electroplating or hot-dipped plating a steel sheet with respect to Claims 14-15.

Immediately following that acknowledgement, the rejection states as follows:

But, it is well settled that there is no invention in the discovery of a general formula if it covers a composition described in the prior art, *In re Cooper and Foley* 1943 C.D. 357, 553 O.G. 177; 57 USPQ 117, *Taklatwalla v. Marburg*, 620 O.G. 685, 1949 C.D. 77, and *In re Pilling*, 403 O.G. 513, 44 F(2) 878, 1931 C.D. 75. In the absence of evidence to the contrary, the selection of the proportions of elements would appear to require no more than routine investigation by those ordinary skilled in the art. *In re Austin, et al.*, 149 USPQ 685, 688.

The Appellants do not understand this statement and the dated case law to support the fundamentals of the rejection. In particular, none of the solicited claims contain a “general formula.” While it is quite common in this art for claims directed to steel sheets to have a general formula or formulae that must be satisfied, this is not such a claim. Therefore, the Appellants are at a loss as to the meaning of this portion of the rejection.

The next portion of the rejection reads as follows:

Assuming *arguendo* that the instant recited Si up to 0.45 and N/Al ratio 0.6 or more are supported by instant specification; nevertheless, 0.5 reads on claimed 0.45 and 0.6 reads on 0.55 as calculated from Maid. It is well settled that a *prima facie* case of obviousness would exist where the claimed ranges and prior art do not overlap but are close enough that one ordinary skilled in the art would have expected them to have the same properties, *In re Titanium Metals Corporation of America v. Banner*, 227 USPQ 773 (Fed. Cir. 1985), *In re Woodruff*, 16 USPQ 2d 1934, *In re Hoch*, 428 F.2d 1341, 166 USPQ 406 (CCPA 1970), and *In re Payne* 606 F.2d 303, 203 USPQ 245 (CCPA 1979). To overcome the *prima facie* case, an applicant must show that there are substantial, actual differences between the properties of the claimed compound and the prior art compound. *Hoch*, 428 F.2d 1343-44, 166 USPQ 406 at 409.

The Appellants have already established that the Appellants are fully entitled to claim 0.45% or less of Si and a N/Al ratio of 0.6 or more (as it applies to Claims 16-19). The rejection relies on the

notion that “0.5 reads on claimed 0.45 and 0.6 reads on 0.55 as calculated from Maid.” Both items will be addressed separately.

The Appellants’ claims recite 0.45% or less of Si. On the other hand, Maid discloses 0.5 to 1.0% of Si. The Appellants claim an amount of Si that is no more than 0.45, while Maid discloses an amount of Si that is 0.5% or more (but only up to 1.0%). One skilled in the art can see based on simple mathematics that there is no overlap between the Appellants’ claimed amount of Si and the disclosed amount of Maid. In fact, the Appellants respectfully submit that one skilled in the art can readily see, again based on simple mathematics, that there is a gap between the claimed range of Si and the range of Si disclosed by Maid. The Appellants therefore respectfully submit that 0.5 does not “read” on 0.45. This is the most simple of mathematic principles.

The Appellants’ Claims 16-19 recite a ratio N/AI of 0.6 or more. On the other hand, Maid does not disclose an N/AI ratio at all. There is no recognition in Maid that there is any particular importance to AI and there is no recognition in Maid that there is any particular importance to N, much less the ratio between N and AI. Nonetheless, despite the absence of any teachings or suggestions to do so, the Examiner has calculated an N/AI ratio point that is 0.55. The Appellants do not take issue with the accuracy of the Examiner’s calculation that the maximum N/AI ratio is 0.55. However, the Appellants do take issue with the notion that one skilled in the art would calculate such an N/AI ratio based on the teachings of Maid.

In any event, the rejection relies on the notion that “0.6 reads on 0.55.” The Appellants’ Claims 16-19 recite 0.6 or more, while the maximum N/AI ratio calculated from Maid to 0.55. These two points/ranges do not overlap. In fact, the Appellants respectfully submit that there is a gap between 0.6 and 0.55. Again, this is simple mathematics. The Appellants therefore respectfully submit that it is inherently impossible for 0.6 to read on 0.55. That statement is simply not accurate.

That portion of the rejection also states that the Appellants must show substantial, actual differences between the properties of the claimed compound and the prior art compound since a *prima facie* case of obviousness has been established. The Appellants disagree with the notion that a *prima facie* case of obviousness has been established. What the rejection fails to mention is that the Maid N/Al ratio of 0.55 is the uppermost end of the Maid range and the N/Al ratios of Maid range downwardly from 0.55. It should also be noted that Maid does not actually disclose this number. It is a number calculated by the Examiner that Maid did not even recognize.

Thus, the case arises that the Maid range is less than 0.55 and the Appellants' range is 0.6 or more in Claims 16-19. There is no overlap, there is substantial space between the two and there is utterly no teaching or suggestion to those skilled in the art that the Maid range should increase above 0.55 and/or that there would be any advantage to be gained by so doing. This is because Maid does not even recognize the ratio much less teach or suggest what it could or should be. The fact that Maid utterly fails to have any discussion concerning the amount of Al other than the stated ranges would not provide any teaching or suggestion to one skilled in the art that there is any particular importance associated with the amount of Al, much less the amount of Al relevant to N or how Al would effect the amount of N whether dissolved or otherwise.

In sharp contrast, the Appellants have discovered that there is a significant correlation between the amount of Al, the amount of dissolved N and the size of ferrite grains. Moreover, the Appellants respectfully submit that not only is there not a *prima facie* case based on the facts, but that the Appellants have no burden to show substantial, additional differences between the properties of the claimed compound and the prior art compound for reasons beyond the differences already established, namely the admitted failure of Maid to disclose, teach or suggest the claimed N/Al ratio, the amount of dissolved N in the steel and the ferrite grain size.

Thus, the Appellants respectfully submit that there is no *prima facie* case of obviousness in this case and the Appellants are under no burden to submit further proofs. (Nonetheless, the Appellants will address this issue further in this Appeal Brief at a later time.)

The rejection also recites that the Appellants' claimed dissolved N content would be inherently possessed as follows:

With respect to the dissolved N content, which would have been inherently possessed by alloy steel of Maid since the claimed N content and other alloying elements' contents, microstructure, tensile properties, hot rolling, and bake hardening steps are overlapped. Therefore, it would have been obvious to one of ordinary skill in the art to select any portion of range, including the claimed range, from the broader range disclosed in a prior art reference because the prior art reference finds that the prior art composition in the entire disclosed range has a suitable utility. Also see MPEP §2131.03 and §2123.

The rejection also takes the position that the amount of dissolved N "would have been inherently possessed by alloy steel of Maid since the claimed N content and other alloying elements' contents, microstructure, tensile properties, hot rolling and baked hardening steps are overlapped." The Appellants respectfully submit that this is inaccurate. The Appellants have already established that the alloying elements contents do not overlap and are not the same. Maid does not disclose the claimed amount of less than 0.02% of Al. Instead, Maid discloses a larger range of 0.02-0.010% of Al. Therefore, there is an alloying element that is particularly important and that has not overlapped with Maid. Also, there is no establishment that the microstructure of Maid is the same as that as claimed. That is merely speculation in the rejection not supported by the prior art relied upon.

There is still a further difference in the alloy composition inasmuch as Claims 1, 2, 10, and 12 recite that there is 0.45% or less of Si. This is sharply contrasted to Maid which discloses 0.5 to 1.0% of Si. Thus, this is a second element in the Appellants' claimed composition that is different from Maid. In view of at least two differences in elements forming the composition, the Appellants

respectfully submit that it would be mere speculation that the dissolved N content would have inherently been possessed by the alloy steel of Maid. In that regard, the Appellants note that a rejection based on inherency must demonstrate that the claimed characteristic is “necessarily” present in the prior art. The Appellants respectfully submit that the rejection fails to establish this. The rejection is based on the notion that the compositions are the same. The Appellants have established that they are not. Those skilled in the art are well aware of the fact that even small amounts of changes in elements in a steel composition can have significant and often dramatic changes in the characteristics of the steel. This is in addition to differences in the methods of forming the steel compositions. Inasmuch as this portion of the rejection is based on the identity of the two compositions and the Appellants have established the lack of identity, the Appellants respectfully submit that the Examiner has not established that the claimed characteristic will “necessarily” be present. It is not enough that the claimed characteristic might be present, could be present, or might even possibly likely be present. It must “necessarily” be present and the record has not established that to be the case.

There is a further important fact associated with the amount of Al that is not appreciated by Maid. As previously noted, the Appellants discovered that there is a significant correlation between the amount of Al, the amount of dissolved N and the size of ferrite grains. The Appellants have further discovered that there is a significant correlation that involves the amount of Si. In particular, the Appellants have discovered that, in view of the ready combination of Si with N, the amount of Si, which now is limited to 0.45% or less, provides a reduced opportunity to combine with N. As a consequence, the lesser quantity of N allows for an increase in the N/Al ratio. None of these individual points taken alone and certainly none of the points taken in combination are taught or suggested by Maid in any way. The Appellants therefore respectfully submit that the Examiner has

failed to produce evidence on the record that can support a rejection of *prima facie* obviousness. It must be remembered that the prior art must provide teachings and suggestions to make modifications to the prior art before an obviousness rejection can be supported. There are no such teachings or suggestions in Maid (or Tosaka).

The rejection takes the position that the “*Applicant* must show that there are substantial, actual differences between the properties of the claimed compound and the prior art compound.” That position relies on an old case that is factually distinguishable from the facts in this situation. The Appellants respectfully submit that this portion of the rejection applies an improper test of patentability under §103. The PTO has the burden of demonstrating that there are teachings or suggestions in the prior art to make modifications that would lead to the claimed subject matter. The rejection does not provide and/or identify such teachings or suggestions. Instead, the rejection relies on factually incorrect “statements,” i.e., not evidence, about what the prior art discloses and applies those incorrect statements to form an erroneous *prima facie* argument of obviousness.

The Appellants respectfully submit that the rejection must be based on teachings and suggestions of the prior art that are also based on actual facts in the prior art. The facts are, for example, that Maid discloses a range of 0.02 – 0.10% Al. There is not one teaching and not one suggestion in Maid that the range of Al could or should be below 0.02. Careful scrutiny of the entire Maid document reveals that there is not one word that would lead one skilled in the art to turn away from the disclosed range of Maid. Therefore, there are no teachings or suggestions to move toward the Appellants’ claimed range.

The same thing can be said for the Appellants’ claimed range of 0.45% or less of Si. In sharp contrast, Maid discloses a range of 0.5 – 1.0% Si. Again, careful scrutiny of the entire Maid disclosure reveals that there is not one word that would suggest to one skilled in the art that the

amount of Si should be lowered below the stated range. There are also no suggestions that doing so would or could provide any advantage. To suggest otherwise is merely speculation not supported by the actual Maid disclosure.

Moreover, there is a complete failure on the part of Maid to appreciate the above-mentioned significant correlation between the amount of Si, the amount of Al, the amount of dissolved N and the size of the ferrite range. This is a synergistic effect brought about by the Appellants' combination of components that is not disclosed, not taught and not suggested by Maid.

The rejection turns to Tosaka to provide the teachings concerning the claimed ferrite grain size. The Appellants respectfully submit that one skilled in the art would not hypothetically combine Tosaka with Maid and, in any event, the hypothetical combination is non-enabling with respect to the Appellants' claims. First, the Appellants respectfully submit that one skilled in the art would not combine Tosaka with Maid. The reasons for this are simple. Maid discloses a hot-rolled steel strip. In sharp contrast, Tosaka discloses cold-rolled steel sheets. This alone would give one skilled in the art pause as to making the hypothetical combination. This problem is magnified, however, because of the particular reason that Tosaka is relied upon in combination with Maid. As noted in the rejection, Tosaka is relied upon for the teachings of the claimed ferrite grain size. The problem with this is that Tosaka provides so-called "uniform and fine recrystallized ferrite structure having a mean grain diameter of  $20\mu\text{m}$  or less" based on cold rolling and not hot rolling. This is explicitly taught in column 4 beginning at line 43 which states:

As for the cold rolling, generally the reduction rate in thickness should desirably be high in order to obtain a fine recrystallized structure after annealing. In view of this, the lower limit of the reduction rate in thickness is set to 50%.

What this means to one skilled in the art is that the grain sizes of Tosaka which are said to be  $20\mu\text{m}$  or less are achieved first by cold rolling and then by annealing subsequent to that cold rolling. There

is utterly no teaching or suggestion in Tosaka as to how to achieve a ferrite phase having an average grain size of  $10\mu\text{m}$  or less for a hot-rolled steel sheet. Tosaka is only able to establish the grain diameters of  $20\mu\text{m}$  or less in the context of cold rolling, not hot rolling. Thus, one skilled in the art would not look to Tosaka to achieve grain sizes of  $10\mu\text{m}$  or less in the context of the claimed hot rolling when Tosaka is directed to grain diameters of  $20\mu\text{m}$  or less in the context of cold rolling.

In any event, the Appellants respectfully submit that Tosaka is non-enabling with respect to providing disclosure, teachings or suggestions to those skilled in the art to achieve a ferrite phase with an average grain size  $10\mu\text{m}$  or less. The reason is that Tosaka provides no teachings with respect to ferrite structure or grain size in the context of hot rolling. Tosaka is only able to achieve fine grains of ferrite after cold rolling, not after hot rolling. The Appellants have carefully scrutinized the entire Tosaka disclosure and there is not one word in that disclosure that would enable one skilled in the art to achieve a ferrite phase with an average grain size of  $10\mu\text{m}$  or less as recited in the solicited claims based on the Tosaka disclosure. Those teachings simply do not exist in Tosaka and Tosaka is accordingly non-enabling.

Tosaka is further non-enabling with respect to the grain size, irrespective of the cold rolling versus hot rolling problem. In that regard, the Appellants invite the Board's attention to Tables 3, 5, 7, 9, 11 and 13 wherein a multiplicity of ferrite grain size diameters are shown based on experiments run in accordance with the teachings of Tosaka. Not a single example was able to achieve a grain size of  $10\mu\text{m}$  or less even in the context of cold rolling, much less in the context of hot rolling as claimed by the Appellants. The Appellants therefore respectfully submit that this is further evidence of the complete non-enablement by Tosaka of the Appellants' claimed ferrite phase of an average grain size of  $10\mu\text{m}$  or less in a hot-rolled sheet. Thus, even if one skilled in the art were to

hypothetically combine Tosaka with Maid, one skilled in the art would still not be able to determine how to achieve the Appellants' specifically claimed grain size in the ferrite phase.

The rejection attempts to rebut the above argument by taking the following position:

Applicants argue that Maid and Tosaka are in different arts. It has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992).

The Appellants have never argued that Maid and Tosaka are "in different arts." The Appellants respectfully submit that this position yet again reveals the lack of understanding of this technology on the one hand and the Appellants' position on the other hand.

The Appellants have repeatedly pointed out throughout the long prosecution history of this application that those skilled in the art plainly understand that there are very dramatic differences in the characteristics of hot rolled versus cold rolled steel sheets. This is particularly important because Maid refers to hot rolled steel sheets, while Tosaka is directed to cold rolled steel sheets. The Appellants do not at all assert that Tosaka and Maid are in different fields of art. They are in similar fields of art. However, one skilled in that art readily recognizes that there are dramatic differences in results when one hot rolls a steel sheet versus when one cold rolls a steel sheet. One skilled in the art also readily recognizes that characteristics obtained in hot rolling are not transferable to cold rolling situations. In fact, those skilled in the art are readily aware that cold rolling steel sheets often times reverses or is deliberately applied to change physical characteristics in hot rolled sheets. Thus, one skilled in the art would not willy-nilly attempt to apply teachings of Tosaka to the teachings of Maid. In any event, the Appellants have established above that even if one skilled in the art were to hypothetically import the teachings of Tosaka to Maid, Tosaka is in any event non-enabling and, therefore, the rejection cannot stand.

The rejection further attempts to justify the application of Tosaka as follows:

Applicants argue that examples of Tosaka fail to disclose the claimed grain size. But, it is well settled that the examples of the cited reference are given by way of illustration and not by way of limitation. In re Widmer, 353 F. 2d 752, 757, 147 USPQ 518, 523 (CCPA 1965), In re Boe, 148 USPQ 507 (CCPA 1966), and In re Snow, 176 USPQ 328.

This statement in the rejection again misstates the Appellants' position. The Appellants do not argue that the "examples" of Tosaka fail to disclose the claimed grain size. Instead, the Appellants argue that all of Tosaka fails to disclose the claimed grain size. One skilled in the art can look at the examples if one skilled in the art so desires. However, although the Appellants have pointed out those differences based on the examples, the Appellants have not limited their distinguishing arguments to those examples. The Appellants have argued that the entirety of Tosaka fails to disclose, teach or even suggest the claimed grain size. The reason the Appellants can substantiate this position is, as noted above, that Tosaka relates to cold rolled grain sizes which have nothing to do with the hot rolled grain sizes of Tosaka and more importantly, have nothing to do with the hot rolled grain sizes of the Appellants' solicited claims. As proof of this difference, the Appellants have indeed referred to the 68 different examples in Tosaka wherein not a single example was able to achieve an average grain size of 10  $\mu\text{m}$  or less as recited in the Appellants' Claims 1, 2, 10, and 12. The Appellants respectfully submit that this is exactly the proof that the rejection seeks in establishing the differences of the solicited claims over Tosaka and Maid, whether taken individually or collectively.

However, there are additional reasons why one skilled in the art would not have a reasonable expectation of achieving the claimed grain sizes. It should also be noted that, even with hot rolling, which is critical to Maid, there are sharp differences between Maid and Tosaka. For example, Maid first heats a continuously cast slab to about 1250°C and then hot rolls and finish rolls the slab to an

end thickness with a finish rolling temperature as close as possible to  $A_{r3}$ . The finish-rolled sheet is then rapidly cooled at a range of 30° to 70°C/sec. Subsequently, the sheets are coiled at a temperature of 350°C to 190°C. Maid also explicitly teaches that the coiling temperature “must be adhered to according to the invention.”

In sharp contrast, Tosaka heats the steel slab to a temperature of 1280° to 1180°C, hot-rolls at a finishing temperature of 900 - 800°C and then subjects the finish-rolled sheet to a coiling temperature of 650° - 500°C.

Those of ordinary skill in the art would readily see that there are dramatic differences between the coiling temperatures of Maid and Tosaka. Not only is there no overlap, but there is a vast gap between the 350° highest temperature of Maid and the 500° lowest temperature of Tosaka. This is a signal to those of ordinary skill in the art that there are sharp differences in the approach of these two methodologies. Of course, this does not even mention the fact that there are multiple subsequent treatment steps in Tosaka that are not only not contemplated in Maid, but not desired.

One of the potential consequences of these representative sharp differences in methodology can manifest itself in the amount of dissolved N content. The differences in methodology could, as readily recognized by those of ordinary skill in the art, lead to differences in the potential amount of dissolved N contained within the claimed steel, relative to the steels of both Maid and Tosaka. The Appellants therefore respectfully submit that there is no demonstration on the record that the amount of dissolved N content would inherently be possessed by the alloy steel of Maid, especially since the alloy elements of Maid do not completely overlap with those of the solicited claims.

It is well accepted that “inherency” must be demonstrated to be a characteristic that is necessarily present in the invention as disclosed by the prior art. There is no such demonstration on this record that the dissolved N content would inherently be present. In fact, the Appellants

respectfully submit that the differences in methodology between Maid, Tosaka and the Appellants would lead one of ordinary skill in the art to seriously question whether the amount of dissolved N would necessarily be present. Although it might theoretically be possible for the amount of dissolved N content to be present, there is no showing on the record that it would necessarily be so.

As a consequence, the Appellants respectfully submit that one of ordinary skill in the art would not only not have incentive to make the hypothetical combination, but that there are teachings present in both references that would lead one of ordinary skill in the art away from making the hypothetical combination. A particular example of this is found with respect to the ferrite grain size of Tosaka. To achieve that disclosed grain size of 20  $\mu\text{m}$  or less, Tosaka discloses a series of treatment steps that result in such a grain size. The Appellants respectfully submit that one of ordinary skill in the art would be faced with quite a conundrum in reasonably expecting that the ferrite grain size of 20  $\mu\text{m}$  or less of Tosaka would have any chance of being present by utilizing the teachings of Maid.

The rejection indicates that the many examples of grain size in Tosaka, which fall outside of the claimed range, are not limiting of Tosaka and, therefore, that Tosaka does not exclude grain sizes of less than 10  $\mu\text{m}$ . Nonetheless, Tosaka must teach or suggest the other grain size, which it does not. In any event, the mere fact that the claimed grain size range is not excluded from the scope of Tosaka does not render the claimed range obvious. A fair reading of Tosaka clearly reveals that Tosaka contemplates the use of grain sizes between 11 and 20  $\mu\text{m}$ . Tosaka simply provides no suggestion to specifically use a grain size less than 10  $\mu\text{m}$ , let alone to do so in the claimed combination or to do so to achieve steel with the Appellants'  $\Delta\text{TS}$ . Because there is no suggestion to limit the average grain size to 10  $\mu\text{m}$  or less, which, in combination with the claim elements noted

above, is important for achieving steel having the Appellants'  $\Delta$ TS, the claimed range would not have been obvious even if Maid and Tosaka were combined.

As previously noted, certain of the process steps of Maid and Tosaka are dramatically different. Therefore, the Appellants respectfully submit that one of ordinary skill in the art would have no reasonable expectation that utilizing the teachings of Maid would in any way result in ferrite grain sizes of 20  $\mu$ m or less since at least half of the steps utilized to form the steels of Tosaka are not even present in Maid, much less there be any similarity to those steps. One of ordinary skill in the art would realize that, to achieve the ferrite grain size of 20  $\mu$ m or less, substantial portions of the methodology of Tosaka would need to be imported as well. However, there is no teaching or suggestion to do so, no teaching or suggestion that it would be successful if the importation were to be made and, in fact, just the opposite is true. The Appellants have already shown that there are serious differences in approach to the hot rolling steps as taken by Tosaka compared to Maid. What this all means is that one of ordinary skill in the art would not make the hypothetical combination as proposed in the rejection.

The rejection with respect to the claimed amount of aluminum states the following:

But, applicants fail to disclose or substantiate how the properties of material different due to the difference between 0.2 wt.% and less than 0.2 wt.%. In re Titanium Metals Corporation of America v. Banner, 227 USPQ 773 (Fed. Cir. 1985), In re Woodruff, 16 USPQ 2d 1934, In re Hoch, 428 F.2d 1341, 166 USPQ 406 (CCPA 1970), and In re Payne 606 F.2d 303, 203 USPQ 245 (CCPA 1979).

The Appellants respectfully contend that the Al content of less than 0.02%, in combination with other claimed elements, is indeed important to achieving steel having properties that are neither described nor suggested by Maid (or Tosaka). One novel property of the claimed steels is an increase in tensile strength ( $\Delta$ TS). The importance of  $\Delta$ TS is discussed below.

The claimed steel sheet becomes hard after press forming due to strain age hardening occurring in the paint baking step and the hardness contributes to improvements in impact and fatigue resistance. Strain age hardening referred to herein means not only an increase in YP, yield point, (=BH) but also an increase in TS, tensile strength (=ΔTS). To increase impact and fatigue resistance, an increase in only YP is insufficient. An increase in TS is also necessary. The increase in YP only improves elastic deformation strength, whereas plastic deformation strength is not improved. The increase in TS improves plastic deformation strength. An increase in TS is a new function of a steel sheet which has never been secured.

By way of further explanation, the Appellants resubmit Exhibit 1 (it is already on the record) for the Boards' convenience, which is a graph of stress-strain curves for a conventional steel alloy (in gray, starting near the origin), an alloy having increased yield point, BH, only (in black, starting to the right of the origin adjacent the 2% label), and a claimed alloy, which shows an increase in yield point and an increase in tensile strength, ΔTS (in black, starting to the right of the 2% label).

Exhibit 1 shows that the steel having high BH only exhibits high deformation resistance in elastic deformation. It is true that high BH steel is strong in the typical use such as when pushed by hand in elastic deformation range. On the other hand, the steel having high ΔTS exhibits high deformation resistance both in elastic and plastic deformation. The ΔTS is important, for example, when a car is involved in an automobile collision, which involves plastic deformation. The car made of high ΔTS steel will not readily deform in a collision. On the other hand, the car made of high BH steel can easily deform in a collision.

Both Maid and Tosaka describe steel sheets having BH, but not ΔTS. Thus, the ΔTS represents an important difference between the claimed steel and that of the prior art. In order to achieve the Appellants' ΔTS, the combination of all of the following elements should be satisfied:

- (1) Al content of less than 0.02%,
- (2) N content of 0.0050 to 0.0250%,
- (3) N/Al is 0.3 or more,
- (4) N in a solid solution state is 0.0010% or more, and
- (5) average crystal grain size is 10  $\mu\text{m}$  or less.

The Appellants respectfully submit that that the prior art of record provides no suggestion to provide steel having such a  $\Delta\text{TS}$ . In addition, the prior art fails to teach or suggest several of the elements necessary to achieve  $\Delta\text{TS}$ , and certainly does not describe or suggest them in the claimed combination. As explained earlier, Maid does not describe an Al content of less than 0.02%. The Examiner has also acknowledged that Maid does not disclose the claimed N/Al ratio of 0.3 or more, the amount of N in a solid solution and the ferrite grain size of 10 $\mu\text{m}$  or less. Tosaka does not disclose N content, solid solution N content or the N/Al ratio. In addition, even if combined, both references fail to suggest, among other things, the claimed average crystal grain size. Thus, even when combined, both references are collectively non-enabling. This alone compels allowance of the claims.

It is also important to note that, even if a hypothetical combination were to be made, the resulting combination would still fail to teach or suggest the subject matter recited in Claims 1, 2, 10, and 12, especially in view of the unexpected results obtained by the Appellants.

In that regard, an important function that the claimed steel sheet has is the function in which TS increases from distortion age-hardening at the time of paint baking. This function is a function which is not found in conventional steel plates. The function of the steel sheets of Maid is called "BH" (Bake Hardenability). That function is a function in which only the YP increases (Column 5, lines 6 - 11). The function of BH in which the Appellants' TS increases is completely different.

The results achieved by the Appellants are reached by combining conventional functions and the known art of BH. For example, even if chemical components overlap, if the microstructure of the steel is not controlled delicately, the Appellants' function is not obtained. For example, steel A1 of the comparative example of the Appellants' Table 16 is a steel which combined crystal grain size of Tosaka and Maid. That steel has a 2-phase microstructure. That steel has a 0.7 or less yield ratio as shown in Maid. That steel has the same diameter of a crystal grain of 20  $\mu\text{m}$  or less as Tosaka. The amount of dissolution N of that steel is 0.0010%. The amount of BH of that steel is 82MPa. This is almost the same as the BH of 40 to 80MPa in Maid. However, the  $\Delta\text{TS(s)}$  of that steel is only 35 MPa. The  $\Delta\text{TS(s)}$  is 40 MPa or more in the claimed steels.

It is clear from the Appellants' Table 3 that the steel which has a chemical component range which satisfies components (1) and (2) satisfies the demand characteristic of the solicited claims. Based on Table 3 of the Appellants' Specification, the influence of the amount of dissolution N on BH and  $\Delta\text{TS}$  is shown in attached Fig. 1. In the amount of dissolution N,  $\Delta\text{TS}$  increases rapidly at 0.0010% or more. The influence constituent features (4) have on  $\Delta\text{TS}$  is clearly proved in attached Fig. 1. Based on Table 3, the N/aluminum ratio shows the influence which BH and  $\Delta\text{TS}$  have in attached Fig. 2. In order to clarify the influence of the chemical components, steel K and steel L, which do not satisfy constituent features were excepted. In the N/aluminum ratio,  $\Delta\text{TS}$  increases rapidly or more by 0.3 as shown in attached Fig. 2. The influence constituent features (3) have on  $\Delta\text{TS}$  is clearly proved in attached Fig. 2.

Based on Table 16 of the Appellants' Specification, the influence that the diameter of crystal grains has on BH and  $\Delta\text{TS}$  is shown in attached Fig. 3. In order to clarify the influence of the diameter of the crystal grains, steel B-2, wherein the amount of dissolution N is not satisfied of constituent features, G4, J2, K1, and L1 excepted. In the diameter of the crystal grains,  $\Delta\text{TS}$  goes up

rapidly at 10  $\mu\text{m}$  or less as shown in attached Fig. 3. The influence which constituent features (5) and  $\Delta\text{TS}$  have is clearly proved in attached Fig. 3.

The correlation with components (1) - (5) and  $\Delta\text{TS}$  is explained with the example. Although control of the chemical constitution is an indispensable requirement that alone is inadequate. A high  $\Delta\text{TS}$  will be realized only after strictly controlling the composition ratio, the form of existence, and the microstructure of steel. That is, if at least one of the requirements is missing, the claimed steels are not attained. Moreover, combining conventional technology which does not take these elements into consideration, will not result in the claimed subject matter.

The Appellants respectfully submit that the above discussion and the attached Figures 1 – 3 developed from the Tables in the Appellants' Specification demonstrate unexpected results beyond what anyone of ordinary skill in the art could have thought possible based on either or both of Maid and Tosaka. In particular, the Appellants have shown unexpected results with respect to the amount of dissolved N, the Appellants have demonstrated unexpected results with respect to the ratio of N/Al and have further demonstrated unexpected results with respect to the diameter of the grain sizes. This demonstration is important because these are three totally independent and separate unexpected results not even remotely suggested by Tosaka and/or Maid. The fact that there are three unexpected results weighs heavily in favor of patentability when patentability can rely on a single showing of unexpected results, much less the three unexpected results that are demonstrated herein. Thus, the Appellants have demonstrated unexpected results with respect to  $\Delta\text{TS}$  and BH, which one of ordinary skill in the art could not have anticipated, based on the primary and secondary references. The result of this is that one of ordinary skill in the art would have had no reasonable expectation of the claimed steel sheets by hypothetically combining Tosaka and Maid.

In conclusion, the elements of (1) Al content of less than 0.02%, (2) N content of 0.0050 to 0.0250%, (3) N/Al of 0.3 or more, (4) N in a solid solution state of 0.0010% or more, and (5) average crystal grain size of 10  $\mu\text{m}$  or less are all important to achieve the claimed steel. For the reasons set forth above, several of these elements, even when considered individually, are not disclosed, taught or suggested in the references of record. The use of the claimed elements in combination with one another is certainly not disclosed or suggested. It is only through the combination, as it is specifically claimed, that one can achieve steel having the Appellants'  $\Delta\text{TS}$ .

The Appellants respectfully request that the rejection of Claims 1-5, 10, 12, and 14-19 accordingly be reversed.

Respectfully submitted,



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### Appendix of Currently Pending Claims

1. A high tensile strength hot-rolled steel sheet having superior strain aging hardenability comprising: in percent by mass,

0.15% or less of C;

0.45% or less of Si;

3.0% or less of Mn;

0.08% or less of P;

0.02% or less of S;

less than 0.02% of Al;

0.0050% to 0.0250% of N; and

the balance being Fe and incidental impurities,

the ratio N (mass%)/Al (mass%) being 0.3 or more,

N in the dissolved state being 0.0030% or more, wherein the hot-rolled steel sheet has a ferrite phase with an average grain size of  $10\mu\text{m}$  or less.

2. A high tensile strength hot-rolled steel sheet having superior strain aging hardenability with a tensile strength of 440 MPa or more comprising: in percent by mass,

0.15% or less of C;

0.45% or less of Si;

3.0% or less of Mn;

0.08% or less of P;

0.02% or less of S;

less than 0.02% of Al;

0.0050% to 0.0250% of N; and

the balance being Fe and incidental impurities,

the ratio N (mass%)/Al (mass%) being 0.3 or more, N in the dissolved state being 0.0030% or more,

wherein the hot-rolled steel sheet has a structure in which the areal rate of the ferrite phase having an average grain size of 10  $\mu\text{m}$  or less is 50% or more.

3. A steel sheet according to Claim 2 further comprising at least one selected from the group consisting of the following Group a to Group d:

Group a: 1.0% or less in total of at least one of Cu, Ni, Cr, and Mo

Group b: 0.1% or less in total of at least one of Nb, Ti, and V

Group c: 0.0030% or less of B

Group d: 0.0010% to 0.010% in total of at least one of Ca and REM.

4. A steel sheet according to either Claim 2 or 3, wherein the high tensile strength hot-rolled sheet has a thickness of 4.0 mm or less.

5. A high tensile strength hot-rolled plated steel sheet produced by electroplating or hot-dip plating a steel sheet according to Claim 2.

10. A high tensile strength hot-rolled steel sheet having superior strain aging hardenability with a BH of 80 MPa or more, a  $\Delta\text{TS}$  of 40 MPa or more, and a tensile strength of 440 MPa or more comprising, in percent by mass,

0.15% or less of C;

0.45% or less of Si;

3.0% or less of Mn;

0.08% or less of P;

0.02% or less of S;

less than 0.02% of Al;  
0.0050% to 0.0250% of N; and  
the balance being Fe and incidental impurities,  
the ratio N (mass%)/Al (mass%) being 0.3 or more, N in the dissolved state being 0.0030% or more,

wherein the hot-rolled steel sheet has a structure in which the areal rate of the ferrite phase having an average grain size of 10  $\mu\text{m}$  or less is 70% or more, and the areal rate of the martensite phase is 5% or more.

12. A high tensile strength hot-rolled steel sheet having superior strain aging hardenability comprising: in percent by mass,

0.03% to 0.1% of C;  
0.45% or less of Si;  
1.0% to 3.0% of Mn;  
0.08% or less of P;  
0.02% or less of S;  
less than 0.02% of Al;  
0.0050% to 0.0250% of N;  
0.1% or less in total of at least one of more than 0.02% to 0.1% of Nb and more than 0.02% to 0.1% of V; and  
the balance being Fe and incidental impurities,  
the ratio N (mass%)/Al (mass%) being 0.3 or more,  
N in the dissolved state being 0.0030% or more,  
the total of precipitated Nb and precipitated V being 0.015% or more,

wherein the hot-rolled steel sheet has a structure in which the areal rate of the ferrite phase having an average grain size of 10  $\mu\text{m}$  or less is 80% or more, and the average grain size of a precipitate comprising a Nb carbonitride or a V carbonitride is 0.05  $\mu\text{m}$  or less.

14. A high tensile strength hot-rolled plated steel sheet produced by electroplating or hot-dip plating a steel sheet according to Claim 3.

15. A high tensile strength hot-rolled plated steel sheet produced by electroplating or hot-dip plating a steel sheet according to Claim 4.

16. A steel sheet according to claim 1, wherein the ratio  $\text{N}/\text{Al}$  is 0.6 or more.

17. A steel sheet according to claim 2, wherein the ratio  $\text{N}/\text{Al}$  is 0.6 or more.

18. A steel sheet according to claim 10, wherein the ratio  $\text{N}/\text{Al}$  is 0.6 or more.

19. A steel sheet according to claim 12, wherein the ratio  $\text{N}/\text{Al}$  is 0.6 or more.